

AMENDMENTS TO THE CLAIMS

10/543167
JC17 Rec'd PCT/PTO 22 JUL 2005

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Currently Amended) A device (4) for routing data units in a network (3), comprising

a receiver (10) for receiving data units from said network,

a buffer (111) for buffering data units received by said receiver,

an output unit (12) for outputting buffered data units to said network on the basis of routing information contained in said data units,

a ~~congestion monitor (110)~~ control unit comprising

means for monitoring whether said device fulfils a predetermined congestion condition,

~~a congestion notification unit (110)~~ means for setting congestion notification information in one or more data units output by said output unit, if said ~~congestion monitor~~ means for monitoring determines that said congestion condition is fulfilled,

~~characterized by~~

~~a congestion cause identifying unit (110) capable of~~ and means for distinguishing between at least two different congestion causes, for identifying one or more causes of said ~~congestion monitor~~ detecting that said ~~congestion condition is fulfilled~~ congestion conditions detected fulfilled by said means for monitoring, and

said ~~congestion-notification-unit~~ means for setting congestion notification information being arranged for setting congestion cause information based on the one or more causes identified by said ~~congestion-cause-identifying unit~~ said means for distinguishing and identifying congestion causes in said one or more data units in which congestion notification information is set.

2. (Currently Amended) A The device according to claim 1, wherein said ~~congestion-monitor~~ means for monitoring is arranged to monitor the degree of utilization of one or more resources of said device, and to determine that the congestion condition is fulfilled if the degree of utilization of at least one of said one or more resources fulfils a predetermined condition.

3. (Currently Amended) A The device according to claim 2, wherein said predetermined condition is the exceeding of a predetermined threshold.

4. (Currently Amended) A The device according to ~~one of claims 1 to 3~~ claim 1, wherein said ~~congestion-cause-identifying unit~~ means for distinguishing and identifying congestion causes is arranged to observe the degree of utilization of two or more resources of said device, and to identify said one or more causes on the basis of the observed degrees of utilization.

5. (Currently Amended) A The device according to ~~one of claims 2 to 4~~ claim 2, wherein said resources comprise a buffering capacity and a data unit processing capacity.

6. (Currently Amended) A The device according to ~~claim 4 or 5~~ claim 4, wherein said resources are grouped into one or more first resources and one or more second resources, and said ~~congestion cause identifying unit~~ means for distinguishing and identifying congestion causes is arranged to identify a first cause on the basis of the degree of utilization of said first resources and a second cause on the basis of the degree of utilization of said second resources.

7. (Currently Amended) A The device according to claim 6, wherein said first resources comprise ~~one or both of~~ a buffering capacity associated with said receiver for buffering data units upon receipt by said receiver, and or a processing capacity for controlling a transfer of data units from said receiver to said output unit, and said second resources comprise ~~one or both of~~ a buffering capacity associated with said output unit for buffering data units to be output, and or a processing capacity for controlling the output of data units from said output unit.

8. (Currently Amended) A method of controlling a device for routing data units in a network, comprising
receiving data units from said network,
buffering data units received by said receiver,

outputting buffered data units to said network on the basis of routing information contained in said data units,
monitoring whether a predetermined congestion condition is fulfilled,
setting congestion notification information in one or more output data units if said congestion condition is fulfilled,
~~characterized by~~
identifying ~~(S22)~~ one or more causes of said congestion condition being fulfilled,
and
setting ~~(S23)~~ congestion cause information based on the one or more identified causes in said one or more data units in which congestion notification information is set.

9. (Currently Amended) A The method according to claim 8, wherein the degree of utilization of one or more resources of said device is monitored, and it is determined that the congestion condition is fulfilled if the degree of utilization of at least one of said one or more resources fulfils a predetermined condition.

10. (Currently Amended) A The method according to claim 9, wherein said predetermined condition is the exceeding of a predetermined threshold.

11. (Currently Amended) A The method according to ~~one of claims 8 to 10~~ claim 8, wherein the degree of utilization of two or more resources of said device is

observed, and said one or more causes are identified on the basis of the observed degrees of utilization.

12. (Currently Amended) A The method according to ~~one of claims 9 to 11~~ claim 9, wherein said resources comprise a buffering capacity and a data unit processing capacity.

13. (Currently Amended) A The method according to claim 11 ~~or 12~~, wherein said resources are grouped into one or more first resources and one or more second resources, and a first cause is identified on the basis of the degree of utilization of said first resources and a second cause is identified on the basis of the degree of utilization of said second resources.

14. (Currently Amended) A The method according to claim 13 wherein said first resources comprise ~~one or both of~~ a buffering capacity associated with said receiver for buffering data units upon receipt by said receiver ~~and~~ or a processing capacity for controlling a transfer of data units from said receiver to said output unit, and said second resources comprise ~~one or both of~~ a buffering capacity associated with said output unit for buffering data units to be output ~~and~~ or a processing capacity for controlling the output of data units from said output unit.

15 - 16. (Cancelled)

17. (Currently Amended) A communication device (34) for sending data units to a receiving communication device (32) over a network (3), said communication device for sending being arranged to receive from said receiving data communication device acknowledgment messages that contain receipt information regarding the receipt of sent data units and congestion notification information regarding congestion in the network, said communication device for sending being arranged to respond to said acknowledgment messages by adapting an operation of controlling the sending of data units in accordance with the information contained in said acknowledgment messages, ~~characterized in that~~ wherein

said communication device for sending is arranged to extract congestion cause information contained in said acknowledgment messages, and to adapt the operation of controlling the sending of data units in accordance with said congestion cause information.

18. (Currently Amended) A The device according to claim 17, wherein the congestion cause information is designed such that the congestion cause information in an acknowledgment message can indicate the presence or absence of n different causes of congestion, such that each acknowledgment message containing congestion cause information contains one of 2^n different combinations of congestion causes, n being an integer, and said communication device for sending is arranged to identify the congestion cause combination contained in an acknowledgment message and to invoke a response procedure corresponding to the identified congestion cause combination.

19. (Currently Amended) A The device according to ~~claim 17 or 18~~ claim 17, wherein said communication device for sending is arranged to extract at least a first and a second congestion cause information, said first congestion cause information being associated with congestion due to the incapacity to handle the number of data units being transported, and said second congestion cause information being associated with congestion due to the incapacity to handle the amount of data being transported, and said communication device for sending is arranged to respond to the extraction of said first congestion cause information by reducing the number of data units output per unit of time, and to respond to the extraction of said second congestion cause information by reducing the amount of data output per unit of time.

20. (Currently Amended) A method for controlling a sending communication device that is sending data units to a receiving communication device over a network, comprising:

receiving from said receiving communication device acknowledgment messages that contain receipt information regarding the receipt of sent data units and congestion notification information regarding congestion in the network, responding to said acknowledgment messages by adapting an operation of controlling the sending of data units in accordance with the information contained in said acknowledgment messages, characterized by extracting ~~(S62)~~ congestion cause information contained in said acknowledgment messages at said sending communication device, and

adapting ~~(S63)~~ the operation of controlling the sending of data units in accordance with said extracted congestion cause information.

21. (Currently Amended) A The method according to claim 20, wherein the congestion cause information is designed such that the congestion cause information in an acknowledgment message can indicate the presence or absence of n different causes of congestion, such that each acknowledgment message containing congestion cause information contains one of 2^n different combinations of congestion causes, n being an integer, and said method further comprising:

identifying the congestion cause combination contained in an acknowledgment message and

invoking a response procedure corresponding to the identified congestion cause combination.

22. (Currently Amended) A The method according to claim 20 ~~or 21~~, wherein said sending communication device is arranged to extract at least a first and a second congestion cause information, said first congestion cause information being associated with congestion due to the incapacity to handle the number of data units being transported, and said second congestion cause information being associated with congestion due to the incapacity to handle the amount of data being transported, and said method further comprising:

responding to the extraction of said first congestion cause information by reducing the number of data units output per unit of time, and

responding to the extraction of said second congestion cause information by reducing the amount of data output per unit of time.

23 - 24. (Cancelled)

25. (Currently Amended) A method of sending data units over a network ~~{3}~~, comprising:

sending data units into said network out of a sending communication device ~~{31}~~ connected to said network,

forwarding said data units in one or more routing devices ~~{33-44}~~ of said network to a receiving communication device ~~{32}~~ connected to said network, each routing device buffering data units received from said network, outputting buffered data units to said network on the basis of routing information contained in said data units, monitoring whether a predetermined congestion condition is fulfilled, setting congestion notification information in one or more output data units if said congestion condition is fulfilled, identifying one or more causes of said congestion condition being fulfilled, and setting congestion cause information based on the one or more identified causes in said one or more data units in which congestion notification information is set,

receiving said forwarded data units at said receiving communication device, said receiving communication device sending acknowledgment messages into said network, said acknowledgment messages containing receipt information regarding the receipt of said forwarded data units as well as congestion

notification information and congestion cause information set by said one or more routers in said forwarded data units,
forwarding said acknowledgment messages through said network to said sending communication device,
receiving said acknowledgment messages at said sending communication device and responding to said acknowledgment messages by adapting an operation of controlling the sending of data units in accordance with the information contained in said acknowledgment messages, extracting said congestion cause information contained in said acknowledgment messages at said sending communication device, and adapting the operation of controlling the sending of data units in accordance with said extracted congestion cause information.